WHAT IS CLAIMED IS:

1. A friction stir welding system comprising:

a friction stir welding (FSW) device comprising an actuator capable of moving a FSW tool relative to a workpiece; and

a controller capable of controlling the FSW device to drive the actuator to move the FSW relative to the workpiece such that the FSW tool is capable of performing a friction stir welding operation on the workpiece, wherein the controller is capable of monitoring a torque of the actuator, and wherein the controller is capable of controlling the FSW device to drive the actuator such that the torque is maintained within a range about a torque setting.

2. A friction stir welding system according to Claim 1, wherein the actuator comprises a plunge actuator capable of moving the FSW tool along a plunge axis, wherein the controller is capable of controlling the FSW device such that the plunge actuator is driven to move the FSW tool into further contact with the workpiece when the torque decreases below a range about a plunge torque setting, and driven to move the FSW tool into reduced contact with the workpiece when the torque increases above the range about the plunge torque setting.

3. A friction stir welding system according to Claim 2, wherein the controller is capable of controlling the FSW device such that, when the torque decreases below the range about the plunge torque setting, the plunge actuator is driven to move the FSW tool into further contact with the workpiece until one of the torque increases to within the range and the FSW tool has moved more than a defined distance along the plunge axis.

4. A friction stir welding system according to Claim 1, wherein the actuator comprises at least one weld actuator capable of moving the FSW tool along a weld path, wherein the controller is capable of controlling the FSW device such that the at least one weld actuator is driven to move the FSW tool with increased speed along the weld path when at least one torque of the at least one weld actuator decreases below a range about at least one weld torque setting, and driven to move the FSW tool with decreased speed along the weld path when the at least one torque increases above the range about the at least one weld torque setting.

5. A friction stir welding system according to Claim 1, wherein the actuator comprises a spindle actuator capable of rotating the FSW tool relative to the workpiece, wherein the controller is capable of controlling the FSW device such that the spindle actuator is driven to rotate the FSW tool with decreased rotational speed relative to the workpiece when the torque decreases below a range about a spindle torque setting, and driven to rotate the FSW tool with increased rotational speed relative to the workpiece when the torque increases above the range about the spindle torque setting.

6. A friction stir welding (FSW) assembly comprising:

a FSW tool capable of performing a friction stir welding operation on a workpiece; and

a friction stir welding (FSW) device comprising an actuator, wherein the actuator is capable of being driven to move the FSW tool relative to the workpiece such that the FSW tool is capable of performing the friction stir welding operation, wherein a torque of the actuator is capable of being monitored, and wherein the actuator is capable of being driven such that the torque is maintained within a range about a torque setting.

7. A FSW assembly according to Claim 6, wherein the actuator comprises a plunge actuator capable of being driven to move the FSW tool along a plunge axis, wherein the plunge actuator is capable of being driven to move the FSW tool into further contact with the workpiece when the torque decreases below a range about a plunge torque setting, and driven to move the FSW tool into reduced contact with the workpiece when the torque increases above the range about the plunge torque setting.

8. A FSW assembly according to Claim 7, wherein when the torque decreases below the range about the plunge torque setting, the plunge actuator is capable of being driven to move the FSW tool into further contact with the workpiece until one of the torque increases to within the range and the FSW tool has moved more than a defined distance along the plunge axis.

9. A FSW assembly according to Claim 6, wherein the actuator comprises at least one weld actuator capable of being driven to move the FSW tool along a weld path, wherein the at least one weld actuator is capable of being driven to move the FSW tool with increased speed along the weld path when at least one torque of the at least one weld actuator decreases below a range about at least one weld torque setting, and driven to move the FSW tool with decreased speed along the weld path when the at least one torque increases above the range about the at least one weld torque setting.

10. A FSW assembly according to Claim 6, wherein the actuator comprises a spindle actuator capable of being driven to rotate the FSW tool relative to the workpiece, wherein the spindle actuator is capable of being driven to rotate the FSW tool with decreased rotational speed relative to the workpiece when the torque decreases below a range about a spindle torque setting, and driven to move the FSW tool with increased rotational speed relative to the workpiece when the torque increases above the range about the spindle torque setting.

11. A controller comprising:

a processing element capable of driving an actuator to move a friction stir welding (FSW) tool relative to a workpiece such that the FSW tool is capable of performing a friction stir welding operation on the workpiece, wherein the controller is capable of monitoring a torque of the actuator, and wherein the controller is capable of driving the actuator such that the torque is maintained within a range about a torque setting.

12. A controller according to Claim 11, wherein the actuator comprises a plunge actuator capable of moving the FSW tool along a plunge axis, wherein the processing element is capable of driving the plunge actuator to move the FSW tool into further contact with the workpiece when the torque decreases below a range about a plunge torque setting, and driving the plunge actuator to move the FSW tool into reduced contact with the workpiece when the torque increases above the range about the plunge torque setting.

13. A controller according to Claim 12, wherein the processing element is capable of driving the plunge actuator such that, when the torque decreases below the range about the plunge torque setting, the plunge actuator moves the FSW tool into further contact with the workpiece until one of the torque increases to within the range and the FSW tool has moved more than a defined distance along the plunge axis.

14. A controller according to Claim 11, wherein the actuator comprises at least one weld actuator capable of moving the FSW tool along a weld path, wherein the processing element is capable of driving the at least one weld actuator to move the FSW tool with increased speed along the weld path when at least one torque of the at least one weld actuator decreases below a range about at least one weld torque setting, and driving the at least one weld actuator to move the FSW tool with decreased speed along the weld path when the torque increases above the range about the at least one weld torque setting.

15. A controller according to Claim 11, wherein the actuator comprises a spindle actuator capable of rotating the FSW tool relative to the workpiece, wherein the processing element is capable of driving the spindle actuator to rotate the FSW tool with decreased rotational speed relative to the workpiece when the torque decreases below a range about a spindle torque setting, and driving the spindle actuator to rotate the FSW tool with increased rotational speed relative to the workpiece when the torque increases above the range about the spindle torque setting.

16. A method of friction stir welding a workpiece comprising:

driving an actuator to move a friction stir welding (FSW) tool relative to the workpiece such that the FSW tool performs a friction stir welding operation on the workpiece;

monitoring a torque of the actuator; and

controlling the torque such that the torque is maintained within a range about a torque setting as the actuator is driven to move the FSW tool.

17. A method according to Claim 16, wherein the actuator comprises a plunge actuator capable of moving the FSW tool along a plunge axis, wherein controlling a torque comprises controlling a torque of the plunge actuator such that

the plunge actuator is driven to move the FSW tool into further contact with the workpiece when the torque decreases below a range about a plunge torque setting, and driven to move the FSW tool into reduced contact with the workpiece when the torque increases above the range about the plunge torque setting.

18. A method according to Claim 17, wherein controlling a torque comprises controlling a torque of the plunge actuator such that, when the torque decreases below the range about the plunge torque setting, the actuator is driven to move the FSW tool into further contact with the workpiece until one of the torque increases to within the range and the FSW tool has moved more than a defined distance along the plunge axis.

19. A method according to Claim 16, wherein the actuator comprises at least one weld actuator capable of moving the FSW tool along a weld path, wherein controlling a torque comprises controlling at least one torque of the at least one weld actuator such that the at least one weld actuator is driven to move the FSW tool with increased speed along the weld path when the at least one torque decreases below a range about at least one weld torque setting, and driven to move the FSW tool with decreased speed along the weld path when the at least one torque increases above the range about the at least one weld torque setting.

20. A method according to Claim 16, wherein the actuator comprises a spindle actuator capable of rotating the FSW tool relative to the workpiece, wherein controlling a torque comprises controlling the torque of the spindle actuator such that the spindle actuator is driven to move the FSW tool with decreased rotational speed relative to the workpiece when the torque decreases below a range about a spindle torque setting, and driven to move the FSW tool with increased rotational speed relative to the workpiece when the torque increases above the range about the spindle torque setting.